

Shockwave Fabrication of High Performance Thermoelectrics, Phase I

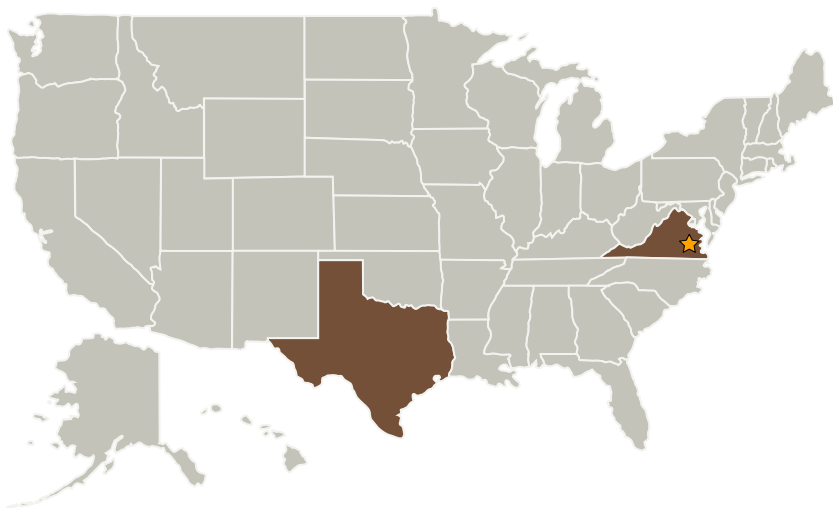
Completed Technology Project (2009 - 2010)



Project Introduction

Thermoelectric (TE) generators/refrigerators have the advantages of lack of moving parts, quiet operation, and flexibility in deployment, but their use has been limited because of their relatively low conversion efficiency. Two major loss components are conductive (phonon) heat transfer through the TE lattice and parasitic losses at fabrication interfaces. Shock wave consolidation of thermoelectric nanopowders to produce TE devices will reduce both loss sources, leading to enhanced efficiency devices. The conversion efficiency of a TE device will always be thermodynamically limited by the Carnot ratio of $(T_h - T_c)/T_h$, where T_h and T_c are the temperatures of the hot and cold junctions. Present technology thermoelectric devices can provide conversion efficiencies up to a third of the Carnot limit. With the restrictions on phonon transport accruing from nanopowder consolidation, conversion efficiencies of over 50% of the Carnot limit should be possible.

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Langley Research Center (LaRC)	Lead Organization	NASA Center	Hampton, Virginia
TXL Group, Inc.	Supporting Organization	Industry	El Paso, Texas



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Langley Research Center (LaRC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Primary U.S. Work Locations

Texas

Virginia

Project Transitions



January 2009: Project Start



January 2010: Closed out

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigators:

David C Nemir

Lawrence W Spradley

Technology Areas

Primary:

- TX03 Aerospace Power and Energy Storage
 - └ TX03.1 Power Generation and Energy Conversion
 - └ TX03.1.3 Static Energy Conversion